

EGU2020-6177

<https://doi.org/10.5194/egusphere-egu2020-6177>

EGU General Assembly 2020

© Author(s) 2020. This work is distributed under the Creative Commons Attribution 4.0 License.



## The influence of greenhouse gases on the 1930s Dust Bowl heat waves across central United States

Sabine Undorf<sup>1,2</sup>, **Tim Cowan**<sup>1,3,4</sup>, Gabi Hegerl<sup>1</sup>, Luke Harrington<sup>5</sup>, and Friederike Otto

<sup>1</sup>University of Edinburgh, Global Change, School of GeoSciences, Edinburgh, United Kingdom of Great Britain and Northern Ireland (s.undorf@ed.ac.uk)

<sup>2</sup>Department of Meteorology and Bolin Centre for Climate Research, Stockholm University, Stockholm, Sweden

<sup>3</sup>Centre for Applied Climate Sciences, University of Southern Queensland, Toowoomba, Australia

<sup>4</sup>Bureau of Meteorology, Melbourne, Australia

<sup>5</sup>Environmental Change Institute, University of Oxford, Oxford, United Kingdom.

The central United States experienced the hottest summers of the twentieth century in 1934 and 1936, with over 40 heat wave days and maximum temperatures surpassing 44°C at some locations like Kansas and Oklahoma. In fact, as of 2019, the summer of 1936 is still the hottest on record. The heat waves coincided with the decade-long Dust Bowl drought, that caused wide-spread crop failures, dust storms that penetrated to New York and considerable out-migration. In a very-large ensemble regional modelling framework, we show that greenhouse gas increases slightly enhanced the frequency and duration of the Dust Bowl heat waves, and would strongly enhance similar heat waves in the present day under current, further elevated greenhouse gas levels. Specifically, present-day atmospheric greenhouse gas forcing would reduce the return period of a rare (less than once in a century) heat wave summer as observed in 1936 to about 1-in 40-years, with further contribution by sea surface warming. Here, we show that a key driver of this elevated heat wave risk is the reduction in evaporative cooling and increase in sensible heating during dry springs and summers. Hence, we conclude that a warmer world is creating the potential for future extreme heat in moisture-limited regions, with potentially very damaging impacts.